

Channel Islands National Marine Sanctuary

2004 Biological Research and Monitoring Summary

Xantus's Murrelet Surveys

Xantus's Murrelets

Xantus's Murrelets (*Synthliboramphus hypoleucus*) were listed as threatened in 2004 by the State of California. These small, black-and-white seabirds from the Alcidae family nest on 12 islands off the coast of Southern California and Baja; the Channel Islands region harbors almost half of the world's total population of 10,000-15,000 birds.

Xantus's Murrelet spotlight surveys and nest monitoring began in 2000 as a part of the Anacapa Island Restoration Project, a project sponsored by the American Trader Trustee Council with support from the sanctuary and Channel Islands National Park. These surveys expanded in 2004, with seabird scientist Darrell Whitworth of the California Institute of Environmental Studies leading nine research cruises from March to May aboard the R/V Shearwater. Islands surveyed included Anacapa, Santa Cruz, Catalina, San Miguel, Santa Rosa, and Santa Barbara.

On Anacapa Island, researchers monitored nests to determine breeding effort and success, timing of breeding, depredation rates, and expansion of murrelets into habitats previously occupied by black rats. Despite a poor nesting effort and delayed breeding in 2004, high hatching success (78 percent), low nest depredation (22 percent), and the continued expansion of the murrelet colony demonstrated the benefits of

the rat eradication program.

In all, 463 murrelets were observed at San Miguel, Santa Cruz, and Catalina islands. No murrelets were seen at Santa Rosa Island. Rough estimates of current colony populations are: 10-50 breeding pairs at San Miguel Island, 100-300 breeding pairs at Santa Cruz Island, 200-600 breeding pairs at Anacapa Island, 500-750 breeding pairs at Santa Barbara Island, and 25-75 breeding pairs at Catalina Island.

The extensive data gathered in 2004 provides vital baseline information for murrelet colonies on the Channel Islands—an important step toward reducing human-related threats and better understanding this species.

Remote Operated Vehicle (ROV) Surveys

The sanctuary, in partnership with California Department of

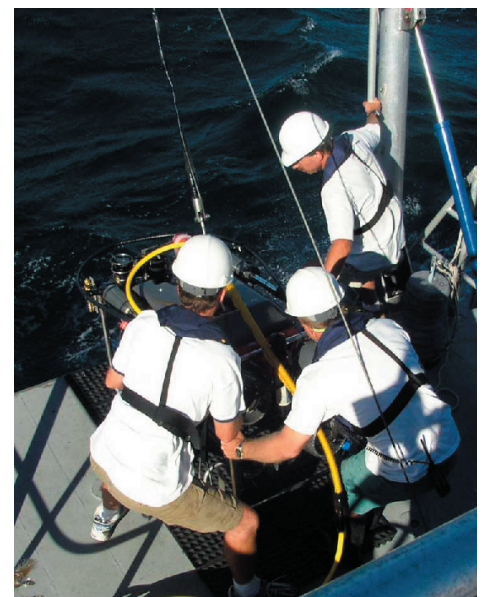


Photo: Jackie Buhl

Researchers deploy the ROV to conduct transect surveys.



Photo: R. Aaron Raymond, The Essential Image Foundation
Xantus's Murrelet chick



Photo: R. Aaron Raymond, The Essential Image Foundation
Researcher Darrell Whitworth examining an adult murrelet for a broodpatch after banding.



2004 Biological Research and Monitoring Summary

Fish and Game (CDFG), The Nature Conservancy, and Marine Applied Research and Exploration, launched "Exploration and Inventory of Santa Barbara Channel Islands Marine Protected Areas—A Cooperative Remote Operated Vehicle Study" to collect geo-referenced digital video across randomized transects inside and adjacent to state marine protected areas (MPAs).

The study's goal is to explore deep water regions of the MPAs using a remotely operated vehicle (ROV) deployed from the R/V Shearwater. In 2004, three surveys—an exploratory survey (May 12-18), quantitative survey (September 6-20), and endangered white abalone (*Haliotis sorenseni*) survey (December 6-12)—resulted in approximately 90 kilometers of transects.

Highlights from the exploratory survey included encounters with two giant seabass (*Stereolepis gigas*), a Pacific electric ray (*Torpedo californica*), thousands of market squid eggs (*Loligo opalescens*), and seafloor beds with millions of brittlestars (*Ophiothrix spiculata*). Researchers also observed a derelict fishing net off North Anacapa Island plus abundant debris like fishing line, soda cans, and ghost traps.

The quantitative survey, designed to detect changes in the seafloor over time, recorded digital video as the ROV flew above the seafloor. CDFG and sanctuary staff, along with Channel Islands Naturalist Corps (CINC) volunteers, classified the habitats in the video transects as boulder, reef, sand, or mixed. Using this data, researchers created maps to help determine prime fish habitat

both inside and outside marine reserves. Researchers also counted and identified targeted species of fish and invertebrates.

The white abalone survey resulted in location and collection of three white abalone for Channel Islands Marine Research Institute (CIMRI) broodstock, and also a survey of preferred habitat (deep water and rocky reefs where elk kelp and other macro-algae can be found). White abalone received endangered species protection in 2001. Today, efforts to save the species center on spawning wild brood stock in laboratories for release into marine reserves. Please see the heading "Endangered White Abalone Restoration" below for more information on the white abalone survey.

REEF Surveys

The sanctuary and REEF (Reef Environmental Education Foundation) cosponsored Channel Islands fish survey trips in May, September, and December. The main focus of these trips was to conduct fish biodiversity and abundance surveys inside the state



Photo: Carl Gwinn

REEF diver with a Pile perch.

marine protected areas (MPAs) and at comparable locations outside the MPAs. REEF staff and Advanced Assessment Team members, sanctuary staff, and NOAA-trained

local divers assisted in the surveys.

A total of 152 surveys were completed at 26 different sites. During the May 5-8 cruise, seven divers conducted over 60 dives at Santa Rosa and San Miguel islands. On the September 22-23 trip, eight divers conducted over 30 dives at Painted Cave, Cuevo Valdez, Potato Rock, Spelunkers, and Scorpion Harbor (all at Santa Cruz Island). On the December 1-4 cruise, five divers conducted 60 dives around Santa Rosa, Santa Cruz, and Santa Barbara islands.

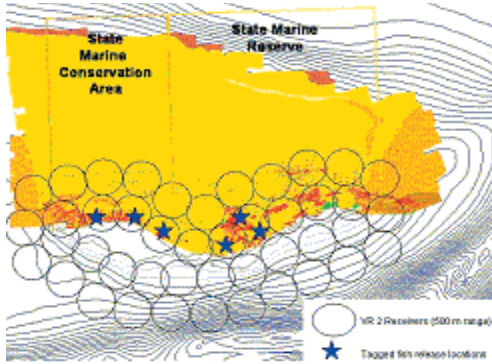
These fish survey trips are part of a long-term monitoring plan developed by REEF that includes 33 sites around the Channel Islands. These sites were selected in consultation with the sanctuary and California Department of Fish and Game. Annual surveys will continue to yield data from this consistent set of sites, identifying species trends over time. For more information visit <http://www.reef.org/sanctuaries/CINMS.html>.

PIER's Acoustic Telemetry Array

The Pflieger Institute of Environmental Research (PIER) has conducted ongoing research on site fidelity and movement patterns of several species of fishes in the sanctuary since 2000. The project is a joint effort between PIER, the sanctuary, and the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO).

Using acoustic telemetry, researchers track the movements of four fish species identified as high priorities by the sanctuary and

2004 Biological Research and Monitoring Summary



Anacapa Island acoustic receiver array. Circles depict the 500m range around each of the deployed receivers and stars depict locations where tagged fish were released.

California Department of Fish and Game: giant sea bass (*Stereolepis gigas*), white sea bass (*Atractoscion nobilis*), California sheephead (*Semicossyphus pulcher*), and kelp bass (*Paralabrax clathratus*). Tracking takes place at selected sites within the sanctuary, including sites off Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara islands (plus Catalina Island and the mainland). The project records the movement of California sheephead and kelp bass into and out of the Anacapa Island State Marine Reserve. Giant sea bass and white sea bass movements are also studied relative to marine reserve boundaries.

Acoustic transmitters are surgically implanted in male and female fish from each species across a range of size classes. After release, movement of tagged fishes is tracked by seafloor-mounted acoustic receiver arrays. Data are retrieved at four-month intervals aboard the PIER vessel R/V Malolo. Receivers are recovered in shallow water (less than 30 meters) by SCUBA divers and in deeper water (more than 30 meters) by ARC 1 acoustic releases, new equipment designed jointly by PIER and DesertStar. The first data downloads for sheephead and kelp bass tagged inside and out of the reserves occurred in September 2004 (Santa Barbara Island)

and October 2004 (Anacapa Island).

One of the overall goals of this project is to minimize incidental giant sea bass mortalities by learning more about the animal in its natural environment through identifying activity patterns and proposing seasonal and/or area closures. An example of an activity pattern that would lend itself to protective time/area closures would be the formation of a spawning aggregation, which would bring a large number of giant sea bass together for a short period and make the fish particularly vulnerable



Photo: Bob Schwemmer

Researcher James Lindholm checks a PIER acoustic receiver.

to exploitation. This type of large scale movement information, plus smaller scale movement patterns near the island, could play an important role in the ongoing process of creating and maintaining effective marine reserves in the Channel Islands.

Plumes and Blooms

Since 1996, the Plumes and Blooms (PnB) project has conducted a field program in collaboration with the sanctuary to study water characteristics in the Santa Barbara Channel. This program is funded by NASA and led by the Institute for Computational Earth System Science (ICESS) at UC Santa Barbara.

PnB researchers correlate

satellite ocean color data with data on quantities of suspended sediments, phytoplankton pigments, and dissolved organic matter in the water column. In 2004, eight PnB cruises took place aboard the R/V Shearwater, collecting data along a seven-station transect from Santa Rosa Island to Goleta Point. The equipment utilized on these cruises includes a radiometer, bio-optical instruments, and water sampling equipment.

During large, intense rains, the entire channel can be covered by sediment-laden water with high nutrient concentrations that affect regional ecosystem dynamics. In 2004, the PnB project published five peer-reviewed manuscripts by two graduate students, Jon Warrick and Mark Otero, that used PnB field data and satellite data to evaluate the impact of sediment runoff on water quality.

Other current research is evaluating the response of phytoplankton to weather changes. Graduate student Clarissa Anderson is using PnB data to write her dissertation on the role of harmful algal blooms in the Santa Barbara Channel. Graduate student Tihomir Kostadinov is developing new mathematical models of ocean color

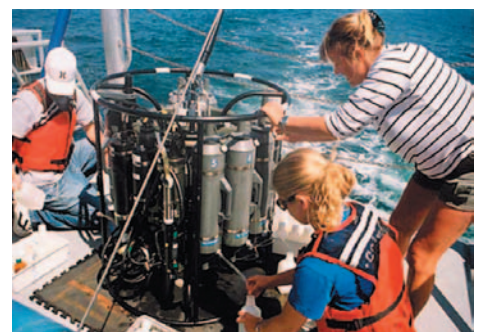


Photo: Amy Cale

Collecting water samples.

2004 Biological Research and Monitoring Summary

that account for changes in optical properties due to intense phytoplankton blooms or sediment runoff. For more information, visit www.ices.ucsb.edu/PnB/PnB.html.

Studying squid using remote sensing technologies

Drs. Roger Hanlon of the Marine Biological Laboratory and Ken Foote of the Woods Hole Oceanographic Institution used the R/V Shearwater for two weeks in February and March to develop a remote-sensing methodology for quantifying egg beds of market squid (*Loligo opalescens*). Other collaborators included California Department of Fish and Game and Santa Barbara City College Marine Diving and Technology Department.

Regions of squid egg beds both inside and outside the sanctuary were identified and mapped using fisheries data and direct observation from a remotely operated vehicle (ROV). These regions were mostly featureless sand bottoms—the species' preferred spawning habitat—with depth ranges of 20-50 meters.

The ROV was used to qualitatively assess the concentration of egg beds. Several sidescan sonar transects were performed in each region of high squid egg concentration, with the equipment towed five meters off the bottom. Relatively featureless sand bottoms without egg beds were also surveyed by sidescan sonar for comparison. SCUBA divers sampled regions of egg bed concentration and also inspected regions lacking egg beds. Biological and physical measurements of individual squid egg beds were performed on board the R/V Shearwater.

While the purpose of this cruise was to develop and test a methodology, it is hoped that the methods in development will help determine annual mating success and future recruitment potential for market squid, the number one fishery in the state.

Sidescan Sonar-Nearshore Benthic Habitat Mapping

The sanctuary, along with the U.S. Geological Survey, completed a two-week cruise from August 15-28 aboard the R/V Shearwater to conduct sidescan sonar mapping and towed video camera options. This partnership with Dr. Guy Cochran, U.S. Geological Survey Geophysicist, has been under way since 1997.

Sidescan sonar mapping of the ocean floor yields data on the types of habitats present inside and outside state marine protected areas (MPAs). Bottom video is collected at select



Retrieval of the sidescan sonar equipment.

locations to ground truth sidescan maps and gather fish and invertebrate diversity and abundance data. In 2004, approximately 62 square kilometers of habitat were mapped at San Miguel Island, within and outside the Harris Point Reserve to a depth of 100 meters. Approximately 6 kilometers of bottom video were collected at Anacapa Island, 13 kilometers at Anacapa Passage, and 4 kilometers at the south side of Santa

Cruz Island.

The sanctuary's nearshore benthic habitats support a variety of endangered marine life that federal and state agencies are mandated to preserve and protect. The data from sidescan sonar, bathymetry, video and dive observations, and physical samples are consolidated into a geographic information system (GIS). The GIS allows researchers and policymakers to see the relationship among data sets—thereby aiding scientific research as well as economic and social decision-making processes.

Ashy Storm-petrel

Ashy Storm-Petrels (*Oceanodroma homochroa*) are rare seabirds that breed from May-November on islands and rocks off the California coast. Approximately half the entire population (less than 10,000 worldwide) of Ashy Storm-Petrels occurs at the Channel Islands. Much concern has been expressed about population declines at two major breeding colonies, the Farallon and Channel Islands. Threats at the islands include human disturbance, habitat destruction, and introduced predators; threats at ocean foraging areas include oil pollution, chemical pollution [DDT], night lights from



Photo: Creed Clayton

Adult Ashy-Storm Petrel in a nesting crevice.

2004 Biological Research and Monitoring Summary

boats, and at-sea weapons testing.

In July 2004, the sanctuary provided vessel support for the annual monitoring of Ashy Storm-Petrels—including population size, breeding success, timing of breeding, and predation—in sea caves at Santa Cruz Island. Nests are monitored according to standardized data collection procedures in place since 1995. Project partners include the U.S. Fish and Wildlife Service, Channel Islands National Park, U.S. Geological Survey, and Humboldt State University.

This research will help develop and implement a future long-term monitoring program for Ashy Storm-Petrels. Long-term monitoring will help assess population trends and reasons for further declines, as well as help develop management actions to protect this species.

Endangered White Abalone,

Haliotis sorensi

From December 5-12, the sanctuary and California Department of Fish and Game (CDFG) conducted a resource assessment of white abalone (*Haliotis sorensi*) around the northern Channel Islands using scuba divers and a remotely operated vehicle (ROV).

The cruise surveyed 19.3 kilometers of habitat near Santa Barbara Harbor and between Yellowbanks and San Pedro Point, Santa Cruz Island aboard the sanctuary vessel R/V Shearwater and the CDFG vessel R/V Garibaldi. First, the ROV was deployed to search for live white abalone, and once an abalone was found, divers were sent down to collect it. Eighteen SCUBA dives were completed in the Yellowbanks area, and three live white

abalone were collected for broodstock. The abalone were found at depths of 20.4 meters, 35.4 meters, and 18.3 meters; they measured 114 millimeters, 170 millimeters, and 105 millimeters respectively; and all were found at a water temperature of 56 degrees F.

In addition to the three white abalone, a pinto abalone measuring 95 millimeters was discovered on one of the dives. Although much of the region surveyed was historically ideal habitat for red and pink abalone, no live abalone of these species were observed. Old, encrusted shells of red and pink abalone were common, but no fresh shells were found.

Another component of the cruise was the placement of Baby Abalone Recruitment Traps (BARTs), which are modified lobster traps. Twelve BARTs were successfully deployed among three locations in the Yellowbanks area at depths of 16.5 meters, 19.5 meters, and 20.1 meters.

The cruise is part of a larger program to actively restore endangered white abalone throughout their historical range in southern California. Future plans call for out-planting of captive reared white abalone in an effort to increase the population of this endangered species.

Rocky Intertidal Monitoring

In January, the R/V Shearwater and sanctuary staff supported four days of intertidal monitoring at Anacapa and Santa Cruz islands as part of the Channel Islands National Park (CINP) long-term intertidal monitoring program. Sites included Frenchy's Cove, Cat Rock, Middle Anacapa East, Middle Anacapa West, and Scorpion Rock.

At these sites, researchers photographed and assessed percent cover in 112 photoplots and counted motile invertebrates in 76 plots. Photoplots are designated areas that are photographed year after year to document changes. At four sites, abalone and sea stars were counted and measured.

The sanctuary and park use the data collected by this long-term monitoring program to record changes in intertidal communities and to provide a baseline for evaluating future population shifts.



Photo: Dan Richards

CINMS staff assist with CINP intertidal monitoring.

PISCO Subtidal Monitoring

From July 13-16, the R/V Shearwater supported four days of marine reserves monitoring in collaboration with scientists from the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO).

This work is a part of the marine reserves monitoring plan coordinated by California Department of Fish and Game. Divers conducted 84 SCUBA survey dives on kelp reefs inside and outside of the sanctuary's marine protected areas (MPAs). Generally two or three teams of two divers each entered the water at a given site and proceeded to run 30-meter transects, collecting data on

densities of fish, invertebrates, and marine plants.

In the future, the R/V Shearwater will support additional SCUBA surveys, ROV surveys, and sidescan sonar surveys as part of the state marine reserves monitoring plan. Other partners in the monitoring plan include the California Department of Fish and Game, U.S. Geological Survey, Pflieger Institute of Environmental Research, Reef Environmental Education Foundation, and Marine Applied Research and Exploration. These surveys are scheduled to take place indefinitely to evaluate the effectiveness of marine reserves.

DELTA Submersible

The sanctuary provided funding for deep water surveys at the Channel Islands using a two-person Delta submersible. Between September 31–October 4, scientists from UC Santa Barbara's Marine Science Institute conducted 21 research dives in and around the islands.

Surveyed sites include San Miguel, Santa Rosa, Santa Cruz, and Anacapa islands, as well as Footprint Reef and several other deep banks near Anacapa and Santa Cruz islands. Dives covered a wide range of habitats, from high rocky outcrops to low relief rock, cobble, sand, and mud bottoms, at depths from 35 to 340 meters. Surveys took place both inside and outside marine reserves.

The research team observed that much of the sanctuary's reef habitat appears relatively undamaged by human activity. No areas were found where the natural mega-invertebrate community (black coral, sponges, crinoids, and the like) had completely vanished. Damage to living

invertebrates included dead areas on individual sponges; researchers hypothesized that the cause may be rubbing of prawn trap lines. Researchers observed relatively little lost fishing gear—some prawn traps, several nets, and longlines. The nets and longlines were almost certainly lost long ago as they tended to be covered with attached invertebrates.

Similar to past observations in southern California waters, low densities of large fishes were observed on most dives. This was particularly true of such economically important species as cowcod (*Sebastes levis*) and bocaccio (*S. paucispinis*). On the other hand, tens of thousands of small fishes were observed in these regions—primarily dwarf species that do not grow large, such as pinkrose (*S. simulator*), pygmy (*S. wilsoni*), and squarespot (*S. hopkinsi*) rockfishes.

However, there was one intriguing exception to this rule. At one reef, very high densities of adult lingcod (*Ophiodon elongatus*) were observed, some of the highest this research team had ever observed in southern California. The scientists intend to return to that site in 2005 to investigate factors that might lead to such anomalous densities.

Finally, discoveries are continuously being made regarding black coral (*Antipathes dendrochristos*). Two of the largest colonies ever seen (three meters in height) were observed in the sanctuary, one of which harbored large numbers of juvenile rockfishes. Observations of dead black corals in deep water at Anacapa indicate that the skeletons of these colonies provide habitats for a wide range of cnidarians, basketstars, brittlestars, crinoids, and fishes.



Photo: Milton Love

Image taken from the Delta sub of the newly discovered christmas tree coral (*Antipathes dendrochristos*) with juvenile squarespot rockfish.

SAMSAP

Initiated in 1997, the Sanctuary Aerial Monitoring Spatial Analysis Program (SAMSAP) monitors and analyzes physical and anthropogenic phenomena in the sanctuary, including commercial and recreational vessel traffic, effects of shore runoff, oil spills, and biological data on marine mammals and giant kelp.

SAMSAP employs regular aerial surveys via a Lake Renegade Seawolf aircraft, gathering data to enhance sanctuary goals of research, education, and resource management. For example, aerial observations of vessel traffic assist in the study of anthropogenic use patterns. A total of 6,866 vessels were observed on 130 flights between June 1997 and August 2004. These vessels are delineated based on the type of activity: commercial

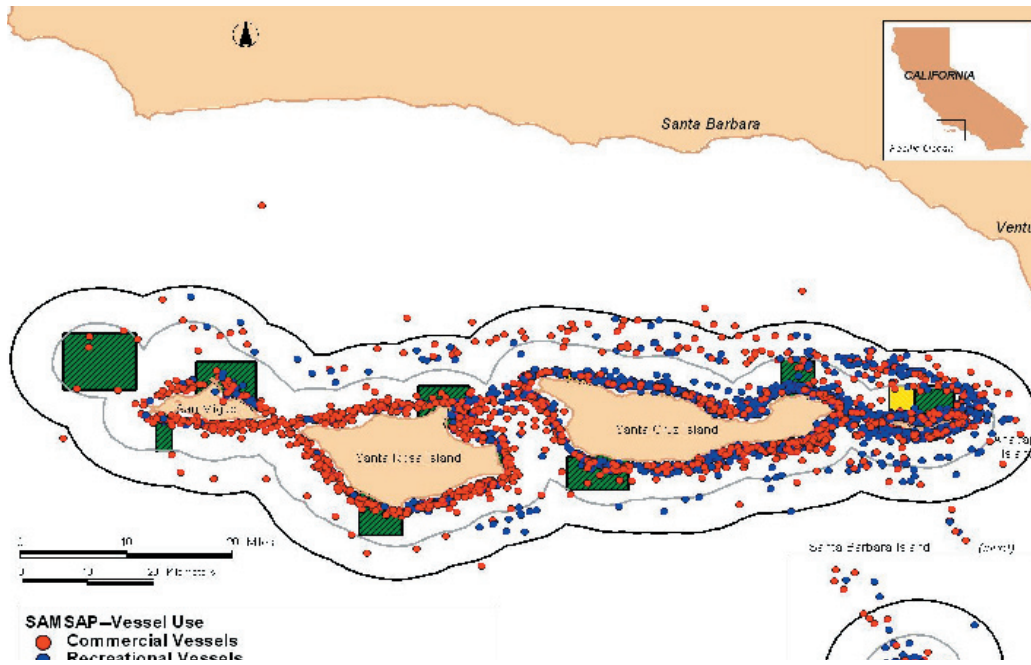


Figure 1. Distribution of all vessels observed between June 1997 and August 2004. Vessels are delineated by activity type: commercial and recreational.

or recreational. Commercial vessels include urchin boats, trawlers, gill netters, lobster boats, and freighters. Recreational vessels include recreational fishing boats, sailboats, and kayaks.

Mapping the locations of recreational vessels versus commercial vessels reveals a distinct spatial divergence. The majority of recreational vessels are concentrated in the eastern portion of the sanctuary, particularly around Santa Barbara, Anacapa, and Santa Cruz islands (Figure 1). These areas are easily accessible because of their proximity to Santa Barbara, Ventura and Channel Islands harbors. Vessel activity in the western portion of the sanctuary consists mostly of commercial fishing vessels.

The majority of commercial and recreational vessels stay in close proximity to the islands. Approximately 94 percent of all vessels are located in state waters, mean high water out to 3 nautical miles (Figure 2). The remaining 6 percent are located in federal waters, from 3 nautical miles to the 6 nautical

mile sanctuary boundary.

This information on use patterns will assist the sanctuary in examining potential vessel displacement from state marine protected areas (MPAs). Vessel displacement could potentially affect the environment by concentrating fishing in smaller areas. SAMSAP data provides a baseline to analyze MPA effects, as the program was established prior to the MPAs.

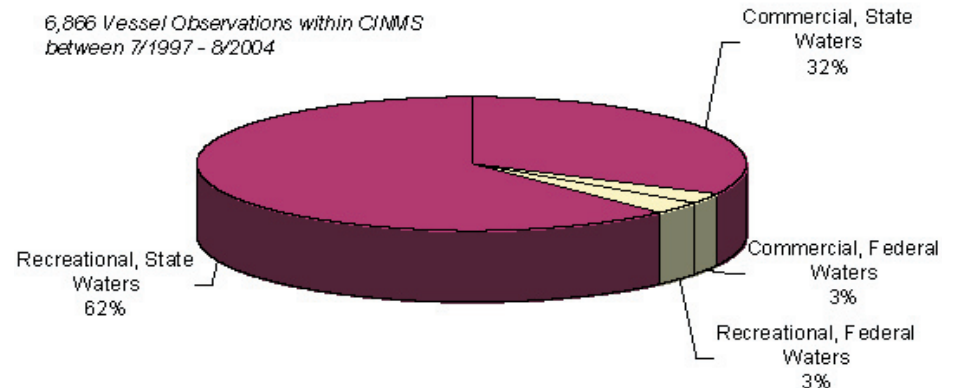


Figure 2. Relative percentage of each vessel type within State and Federal waters. State waters are defined as the region between mean high water and 3 nm, and Federal waters are 3 nm out to the 6 nm CNMS boundary. The majority of both commercial and recreational vessels were located in State waters.